

Newtown South III-2



pennsylvania

DEPARTMENT OF ENVIRONMENTAL PROTECTION

Bureau of Abandoned
Mine Reclamation

NEWTOWN SOUTH II-2 PROJECT

(Contract OSM 54(3649)102.1)

Location

Reilly Township
Schuylkill County, Pennsylvania

Submitted By

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PROJECT START DATE

June 10, 2011

PROJECT COMPLETION DATE

May 5, 2012

CONSTRUCTION COST

AML Title IV Funds - \$ 87,501.99
PA Growing Greener II - \$ 593,254.13

PROJECT PARTNERS

U.S. Department of Interior, Office of Surface Mining (OSM) - Funding and Oversight
PA-DEP BAMR – Development, Design and Construction Management
Pennsylvania Game Commission (PGC) – Property Owner
Indian Head Coal Company (Pagnotti Enterprises) – Property Owner (Access)

CONTRACTOR

Berner Construction, Inc.
Gap, PA

DATE SUBMITTED

May 16, 2013

Introduction

The Newtown South II-2 project is a great example of the good work accomplished by Pennsylvania's abandoned mine land reclamation program. That work - reclaiming hazardous abandoned mines, restoring lands and waters affected by legacy mining, and working with partners - helps our communities by creating jobs, usable land, restored waters, and an environment free from hazards. This project reclaimed open mine hazards in an area visited annually by thousands of hunters, and was part of an ongoing multi-year effort to clean up a watershed which has returned fish to more than seven miles of mine-impacted stream. Backfilling mine openings on the project prevented water infiltration into the underground mine, and existing mine drainage seeps were passively treated. The project also created wetlands and improved wildlife habitat.

Newtown South II-2 is a continuation of the great partnerships Pennsylvania's Bureau of Abandoned Mine Reclamation (BAMR) has had with the Pennsylvania Game Commission (PGC) and the U.S. Office of Surface Mining (OSM) on a number of projects in the area and throughout the state.

Mining History and Watershed Information

The Newtown South II-2 project is located within the Southern Anthracite Coal Field, 40 miles northeast of Harrisburg, in Reilly Township, Schuylkill County, Pennsylvania.



Figure 1. Newtown South II-2 Location

The site had been underground-mined by the Indian Head Coal Company's Blackwood Colliery (Figure 1A - "A" Figures are in the Appendix.) for some 80 years ending in the 1930s when its last Blackwood Breaker burned. The Blackwood Colliery workings undermined the northern slopes of Sharp Mountain south of Swatara and Panther Creeks. Surface mining of the project area was done by the Philadelphia and Reading Coal and Iron Company 1930s - 1963.

Drainage from the project area is to the Northern Swatara Creek. The Swatara Creek an area of 577 mi² in east-central Pennsylvania and is tributary to the Susquehanna River. (Figures A2 and A3) Only the upper 43 mi² area of the watershed is underlain by the Southern Anthracite Field. Several surface and a few underground mines in the watershed are active today, but most mines in the Swatara Creek Basin were abandoned before 1960.

Prior to recent restoration efforts, unreclaimed steep-sided mine pits, steep banks of barren spoil and culm, and fine coal waste in silt basins covered large areas of the watershed. Surface water drained to numerous abandoned underground mines through mine openings, abandoned surface mines and subsidence holes. Further downstream, contaminated groundwater discharged from numerous abandoned mine drainage (AMD) sources, degrading Swatara Creek and rendering the northern 12-mile portion fishless for most of the twentieth century.

Operation Scarlift

Pennsylvania has been a leader in improving the quality of its mined lands for nearly a half-century. Forty-five years ago, its legislature enacted the Land and Water Conservation and Reclamation Act, the first legislation to address reclamation of abandoned mines.

The abandoned mine reclamation portion of the Act, known as “Operation Scarlift”, was administered by the Pennsylvania Department of Environmental Resources (now PADEP). Utilizing Scarlift bond funding, between 1968 and 1981, the Department completed 500 stream pollution abatement projects. Sixteen Scarlift projects were completed in the Swatara Creek Watershed (SCW), with expenditures of more than \$3.5 million between 1969 and 1978.

Swatara Creek Watershed Rehabilitation Plan

In 1998, OSM approved a Hydrologic Unit Plan for the northern headwaters of the SCW. The Restoration Plan included extensive work from a 1994 Comprehensive Mine Reclamation Strategy developed by the PADEP’s Pottsville District Mining Office (PDMO) and from Scarlift Mine Drainage Abatement Studies. A central component of Operation Scarlift was identification of AMD discharges from abandoned deep mines throughout Pennsylvania and to suggest abatement and treatment measures for each. The Swatara Mine Drainage Abatement studies completed during Operation Scarlift identified some 40 AMD discharges and suggested that more than 75% of the pollution load could be prevented by diversion, remining and reclamation.

There has been a concentrated effort from state, federal, local government, industry and local citizens to complete AMD treatment and abatement projects in the SCW. Fourteen passive treatment facilities - wetlands, open limestone channels, oxic and anoxic limestone drains, and diversion wells have been installed to ameliorate AMD impacts in the watershed. Additionally, BAMR has completed fifteen AML projects in the watershed reclaiming 639 acres (Figure 2).

Study and monitoring have made the Swatara Creek efforts one of the best-documented restoration projects in the country. Since 1998, the creek has been the subject of a U.S. Environmental Protection Agency (EPA) Section 319 National Monitoring Program project. The successful implementation of projects in the Restoration Plan and work of BAMR, PADEP PDMO, the Schuylkill County Conservation District (SCCD), United States Geological Survey (USGS), EPA, the Northern Swatara Creek Watershed Association (NSCWA), and the Swatara Creek Watershed Association (SCWA) has resulted in the gradual return of fish to Northern Swatara Creek in the town of Ravine just downstream of the anthracite portion of the watershed.

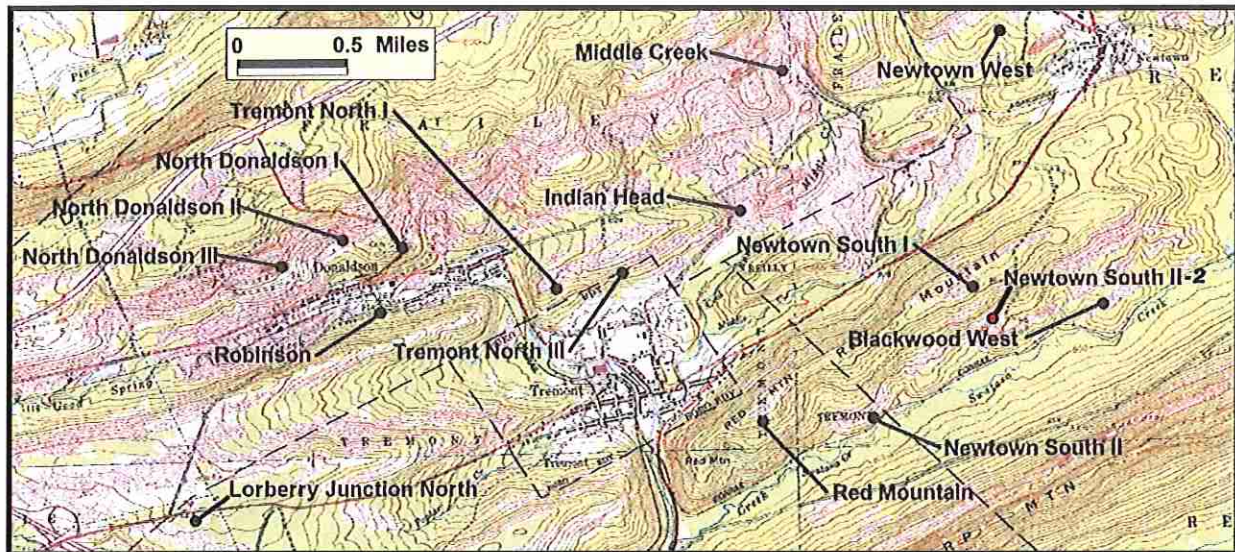


Figure 2. BMR Reclamation Projects in the Swatara Watershed

Before 1985 no fish were found in studies conducted on the Northern Swatara Creek. In the past decade a gradual and steady increase in the number of fish species and individuals has been documented. Dozens of species that had not been present for decades returned to a portion of the creek as a result of infiltration abatement and discharge treatment and the resulting improvements in water quality and stream habitat. Newtown South II-2 continued this effort by reclaiming pits and openings that allowed water to infiltrate into the underground mines, installing passive treatment systems with limestone beds, and constructing wetlands.

Difficulty of Achieving Reclamation Because of Site Conditions

The Newtown South II-2 project re-graded 50 acres of abandoned mine lands and reclaimed features consisting of three vertical openings, four hazardous water bodies and seven pits containing dangerous highwalls totaling 1,200 feet in length. Reclamation was accomplished by utilizing 261,729 cubic yards of onsite material and creation of three wetlands. Two mine water seeps and one discharge are now passively treated using limestone beds and the wetlands. The three vertical openings were reclaimed by backfilling two of them and installing a bat gate in the third. A listing of the features reclaimed is in Figure A4.

Special and Unique Considerations - Passive AMD Treatment

Two passive treatment systems were built to remediate three mine discharges located on the project. These discharges were contributing to the pollution of the SCW. The treatment systems are “Automatic Flushing Up-Flow Limestone Bed Treatment Systems with Polishing Aerobic Wetlands”. Mine discharges are directed to rock filtered intake chambers, conveyed by plastic piping to PVC-lined limestone beds with perforated plastic outflow pipes. The water flows up through the limestone bed, runs into aerobic wetlands, and is discharged to the creek. The systems are back-flushed twice-weekly into settling ponds. The design flow of the systems is 60 GPM @ 18-hour retention, and the total volume that the two systems can treat is approximately 520 GPM before the systems must be bypassed. Photos of the treatment systems and a table describing their performance are in Figures A5 – A11. The system is running well more than a year after installation, with significant water quality improvement as shown on Figure A7.

Special and Unique Considerations - Wildlife Habitat

This site is located entirely within Pennsylvania State Game Land (SGL) 229. State Game Lands are managed by the PGC for hunting and trapping. These lands are donated to the PGC or purchased by the PGC with hunting license fees and other monies. Five of the BAMR projects in the watershed, covering 219 acres, are on SGL 229.



Figure 4. Reclamation on SGL 229

During the design of the project, BAMR staff met with PGC officials who suggested tree and grass seed mixtures to benefit the local wildlife for the project. Twelve bluebird boxes, four wood duck boxes and a bate gate were incorporated into the project. Also, eight stone piles and eight root wads with bole were placed throughout the three wetlands created at the site. Near the end of the design phase, the PGC contacted BAMR about timbering the property prior to the start of construction. BAMR worked with the PGC to ensure that the timbering was completed before the start of the reclamation project, and attention was given to creating wildlife habitat. Black bear, white tail deer, turkey, pheasant, grouse, black snakes, ducks, geese and snapping turtles all have been observed on the project site since completion of reclamation. The PGC has installed additional bluebird boxes on steel poles on the site and mallard rings in the constructed wetlands.

On-Site Difficulty of the Project - Wet Ground Conditions

The most challenging aspect of the project construction was dealing with and controlling wet site conditions, primarily at the mine drainage outflows and in soft, unstable soil areas. (Figures A11 and A12) Design of the project addressed potential water issues by adding a “diversion and care of water” item in the contract, which allowed the contractor to use a wide range of construction resources to deal with water infiltration and flow issues related to construction, and provided PADEP a mechanism to pay for measures taken in controlling troublesome water issues.

Most of the structures designed to collect and treat the mine outflows were located in extremely wet locations with high water tables and very soft, mucky areas containing buildups of yellow-boy. These conditions made construction of the collection ponds and treatment cells

difficult to locate and construct, requiring additional diversion ditches and sumps for pumping and diverting water. The inlet structures for the treatment systems were located at the seeps, and had to be built around the outflows, which had to be controlled during construction. Installation of the inlet pond drain pipes and valves was concurrent with the construction of the pond embankments so the mine drainage could be by-passed from the inlet pond upon completion of the pond itself. This allowed construction of the collection chambers and intake pipes.

Wet and unstable soil caused instability of the sidewalls of the treatment cells and inlet ponds, and the contractor used timber mats to support and distribute the equipment load when working around these. One treatment cell required the use of a long-reach excavator to place the bedding and limestone filter material, and several areas had to be compacted and stabilized.

On-Site Difficulty of the Project – Proximity of Railroad Property

In addition to site conditions, space to locate the mine drainage treatment structures at the south limits of the project was limited by the location/elevation of the mine drainage outflows and proximity of the abutting railroad property where no easements could be secured. The treatment sites had to be built in a restricted, muddy area. (Figures A12, A13)

Onsite Effectiveness

Effective/Innovative use of Technology – AMD Treatment

The two treatment systems installed both utilize several features Wilkes-Barre BAMR had not previously used. Inlet structures utilized stormwater detention chambers with end-caps enclosed in non-calcareous stone to prevent debris from entering the system, and the limestone drains are flushed utilizing a solar-powered-programmed in-line valve. (Figure A10) The intent of up-flow limestone beds is to have the metals precipitate closer to the perforated flush pipes rather than on top of the bed as occurs in a down-flow system or vertical flow pond.

Effective/Innovative use of Technology – Tree Seed Plots

Wildlife habitat tree plots were laid out utilizing seven tree seed areas totaling 7.4 acres within the four grading areas of the project and were planted in April 2012. Brush barriers 10'-12' wide x 6'-8' high were constructed to various lengths. The surrounding surface was ripped with a dozer to a depth of 2', with these ripped furrows continuing outward 50' from each brush barrier in all directions. Soil nutrients and tree seed were hydroseeded and then mulched from outside the 50' perimeter to prevent compaction of the tree seed area. (Below and Figure A14.)

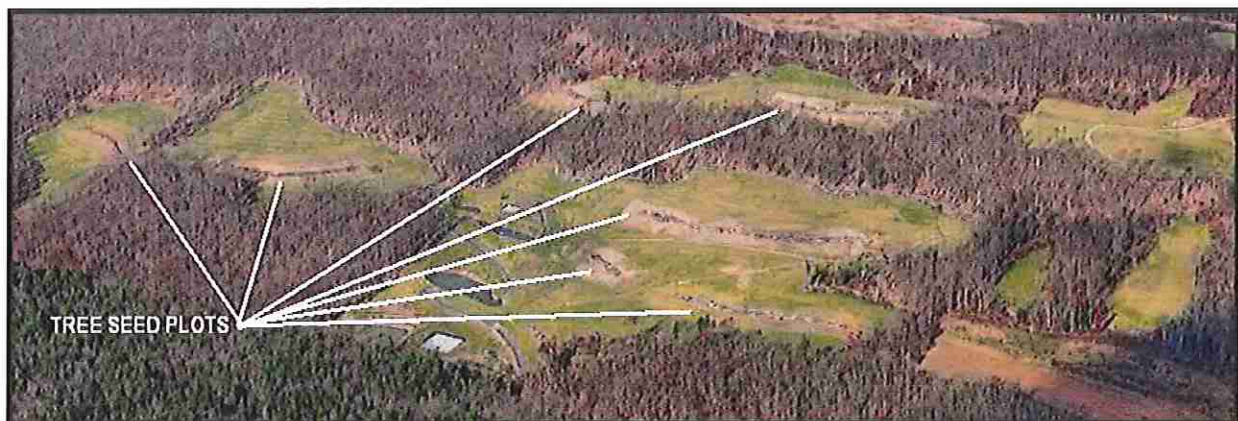


Figure 5. Newtown South II-2 Tree Seed Plots

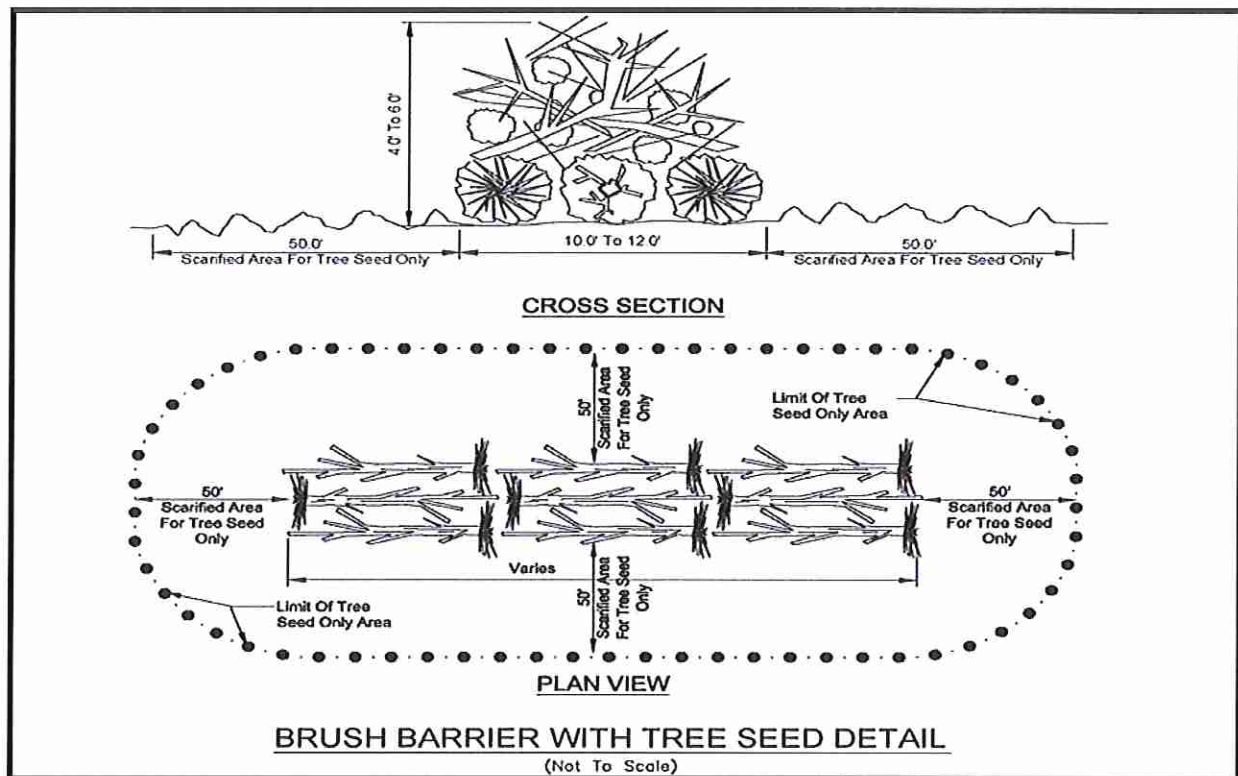


Figure 6. Typical Tree Seed Planting Area

Tree seeds used were Quaking Aspen, Common Persimmon, Russet Buffaloberry, Flowering Dogwood, Eastern White Pine, Cockspur Hawthorn, and American Filbert, native species chosen by the SGC. A table summarizing their performance is in Figure A15.

Resulting Landscape Conforms to the Natural Environment

The PGC did selective timbering on the project area before the contractor began clearing and grubbing. All natural growth, downed timber, logs, trees, poles, roots, stumps and brush cleared and grubbed from the grading areas (approximately 65% of the project area) were placed in brush piles to act as erosion and sedimentation controls and wildlife habitat, or for the brush barrier core units of the above tree planting areas. In addition to the seven tree planting areas, 44 separate brush piles were created. It is anticipated that the tree seed areas will provide wildlife cover similar to the areas in our Branchdale East project OSM 54(3639)102.1, (located some 4 miles east of Newtown South II-2) which was planted in 2009. (Figure A16.)

The landscape of the completed project resembles approximate original contour. (Figure A17) Working with PGC Southeast District, a game-cover seed mixture of Orchardgrass, Little Bluestem, Yellow Blossom Sweet Clover, White Dutch Clover, Vernal Alfalfa, Canada Wild Rye, Birdsfoot Trefoil, Maximillian's Sunflower, Perennial Sweet Pea, Butterfly Milkweed, and Spring Oats was specified for use on the bulk of the grading areas. Photos showing the first year's revegetation and the restoration to original contour are in Figures A18 and A19.

Large stones and stumps from the project area were strategically placed in the constructed wetlands to provide wildlife habitat. (Figures A20 and A21.) Wetland muck and all wetland plant species were harvested from the HWBs in the project area and replanted in the constructed wetlands. Rock piles (approximately 8' square at the base, 1½' high x 5' square at

the top) and trees with root wads were placed in each wetland area. The wetland areas were then seeded with a seed mixture of Rice Cut Grass, Fox Sedge, Hardstem Bulrush, and Annual Ryegrass. Three wetlands totaling 0.65 acres were constructed. These wetlands also serve to polish the treated mine drainage from the treatment facilities.

Elimination of Significant Health and Safety Problems

The three water filled pits (Figures A22 – A24) varied from 200'x50' to 650'x60', each with a highwall with about 20 feet above the water's surface. The water in the pits ranged from 2'- 20' deep. Dirt roads led to and paralleled the pits' sides, and spoil piles 10-20 feet high were also located along portions of the sides of the pits. The area was 80% vegetated, with brush and trees, and edges of the pits were difficult to discern. Slopes of the pit walls varied from 50° to more than 70°. The area had a lot of visitors, evidenced by spent shotgun shells, footprints and tire tracks. Existing unblocked access roads traverse the area making it easily accessed by most people. The PGC estimates some 5000 hunters visit SGL 229 annually.

Theses and four other strip pits had a total of some 1200 feet of highwall with loose unconsolidated material edges above 60° to more than 80° slopes up to 60 feet high. Dirt roads led to and paralleled the pits' sides, and several had well-worn foot paths paralleling the highwall. In addition to the evidence of hunters, bottles, cans, and paper wrappings were littered throughout the top and bottom of the pit, and trash had been dumped throughout the site.

The reclaimed vertical openings were slopes entries with 1'x3' to 2'x5' entrances, partially blocked due to the collapse of overhanging rocks and covered with fallen leaves and tree branches. The PGC Land Manager for Schuylkill and Berks Counties had expressed concern for the health and welfare of people that frequent this area, and two vertical openings had been posted and marked by the PGC before reclamation (Figure A25). Two of the openings were backfilled and a bat gate was installed in the third, at the request of the PGC. (Figures A26-A27)

Funding

Effective Use of Funds

Pennsylvania's 2010 Title IV Non Water grant supplied \$81,813 or 13% of the funding for Newtown South II-2, and Pennsylvania's Growing Greener II (GGII) program supplied the remaining 87%. Pennsylvania's Environmental Stewardship and Watershed Protection Act, commonly known as "Growing Greener," was signed into law in 1999. Growing Greener is the largest single investment of state funds in Pennsylvania's history to address Pennsylvania's critical environmental concerns. GGII, a voter-approved bond issue, was signed into law in June 2005. GGII funds are to be used for serious environmental problems at abandoned mines and waterways, and for other projects.

Leveraging – Use of Partners for Funding or Technology

Design of the treatment systems was based on analyses of Swatara Basin treatment systems performance by the USGS, and feedback on operation and maintenance of the systems by the SCCD and the NSCWA. Operation and maintenance of the treatment systems will be by the Bureau of Conservation and Restoration of PADEP, working with the SCCD. As mentioned above, the PGC worked with BAMR on tree and grass seed mixture selection and wildlife habitat design.

Benefits to the Community

Community Support for the Project

Significant community support existed for this project. The SWCA was founded in 1970 to promote conservation of the watershed and in the early 1990s the NSCWA formed to promote the environmental integrity of Swatara Creek, its tributaries and watershed that lie within the boundaries of Schuylkill County. Local government officials strongly supported the project. On a post-completion tour of the site, the Chairman of the Reilly Township Board of Supervisors said “The Township has pursued this project for a while and we are thankful to see these much-needed funds, which are generated from the mining industry, being put to good use. I’m glad to see this project completed to restore the property back to its original landscape.”

Long-Term Benefits to the Community

The PGC is one of the premier wildlife management agencies in the world. Pennsylvania has always had a strong hunting culture. From its inception in 1895, the PGC has recognized the importance of providing hunting opportunities to all segments of society. The SGL system, composed of 302 blocks of land throughout the Commonwealth containing over 1.4 million acres, provide excellent outdoor recreation and hunting opportunities for more than 1.3 million Pennsylvanians who take to the woods and fields annually.



Figure 8. SGL 229 is Stocked Annually for the PGC Junior Pheasant Hunt

More than 25% of Pennsylvania adults call themselves “hunters”. Most Pennsylvania kids get the first day of deer season off from school because if the school was open, only half the kids would show up. Hunting has been and continues to be a tradition within the watershed, especially in Schuylkill County. Numerous public lands open for hunting are located within the county including SGL, state parks, and state forests. The largest of these is SGL 229. The PGC District Land Manager recently said that SGL 229 is the most used in his district, mainly because it is stocked with pheasants now that open fields, with proper seed mixtures, exist from this and the past game lands reclamation projects.

Newtown South II-2 also helped achieve priorities of the Schuylkill County Open Space and Greenway Plan, the Swatara Creek Rivers Conservation Plan, and the PGC: preserving, maintaining, and enhancing wildlife habitat corridors and areas contiguous to these corridors; working to restore the fishery on the northern section of the watershed; and increasing recreation opportunities for hunters while promoting management of the state's wildlife resources.

Surface Mining Control and Reclamation Act (SMCRA)

Exceeds the Spirit and Intent of SMCRA

The Newtown South II-2 project addressed the reclamation of all of the high-priority AML problems in accordance with the spirit and intent of Title IV of SMCRA, and addressed a number of water-related AML problems in accordance with the restoration plan for this high-visibility watershed, with funding from Pennsylvania Growing Greener. The project's location on publicly owned land that is frequently visited by sportsman and outdoor enthusiasts advertises both the need for and the benefits of a national abandoned mine lands reclamation program. The on-going partnership with the PGC provides additional technical capabilities to the project, and adds enhancement of wildlife habitat to our mission of reclaiming hazardous abandoned mine features and restoring lands and waters affected by legacy mining,

Increased Public Awareness of SMCRA

State legislators; federal, state, and local officials; and watershed and environmental groups have toured the site since the completion of reclamation and the treatment facility. Its relative closeness to the state capitol has made these tours convenient for Pennsylvania officials.



Figure 9. Tour Group of Legislators, Watershed People and Local Officials

During the tour shown in Figure 9, David Argall, the area's State Senator (a member of the Joint Legislative Air and Water Pollution Control and Conservation Committee) stated, "These abandoned strip mines not only leave major eyesores, but also present grave safety

concerns to local residents and visitors. I am grateful for the hard work and leadership of (the) team at the Bureau of (Abandoned) Mine Reclamation to get this important local project completed.” Every hunter who enters SGL 229 sees several BAMR project signs for the abandoned mine land projects that BAMR has been doing there for over ten years. These billboards publicize the SMCRA work being done. (Below and Figures A28 and A29)



Figure 10. Signs Advertising More Than 10 Years of SMCRA to Thousands of Hunters

Transferability to other AML Projects

It is possible that the use and monitoring of the tree seed plots as described above might be a tool to achieve reforestation, as an alternative to the Forestry Reclamation Approach advocated by the Appalachian Regional Reforestation Initiative.

The project exemplifies a comprehensive reclamation approach and part of an on-going total watershed restoration. Site specific AML hazards were targeted and addressed while taking into account methods which would provide both a positive impact upon the watershed and meet the needs and goals of the landowner.



Figure 11. Newtown South II-2 Fall 2012

Newtown South II-2 Appendix



Figure A1. Blackwood Breaker ca. 1930

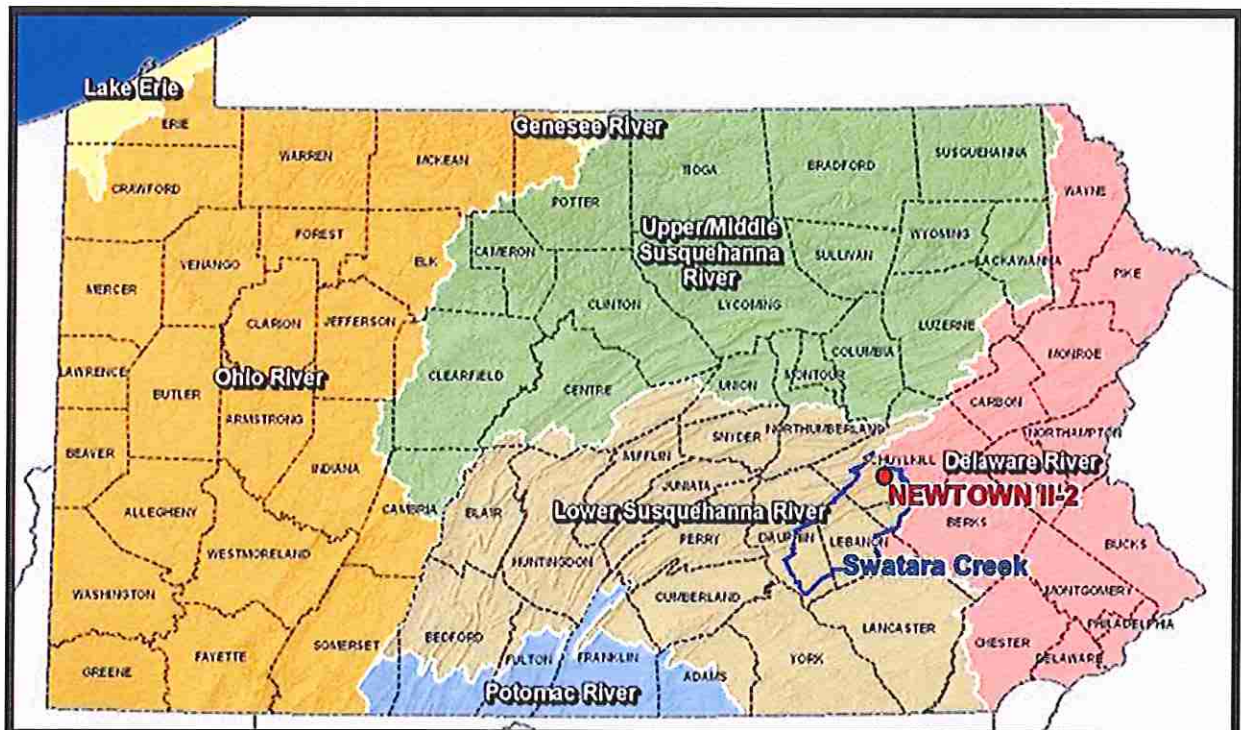


Figure A2. Newtown South II-2 Location, Pennsylvania Watersheds

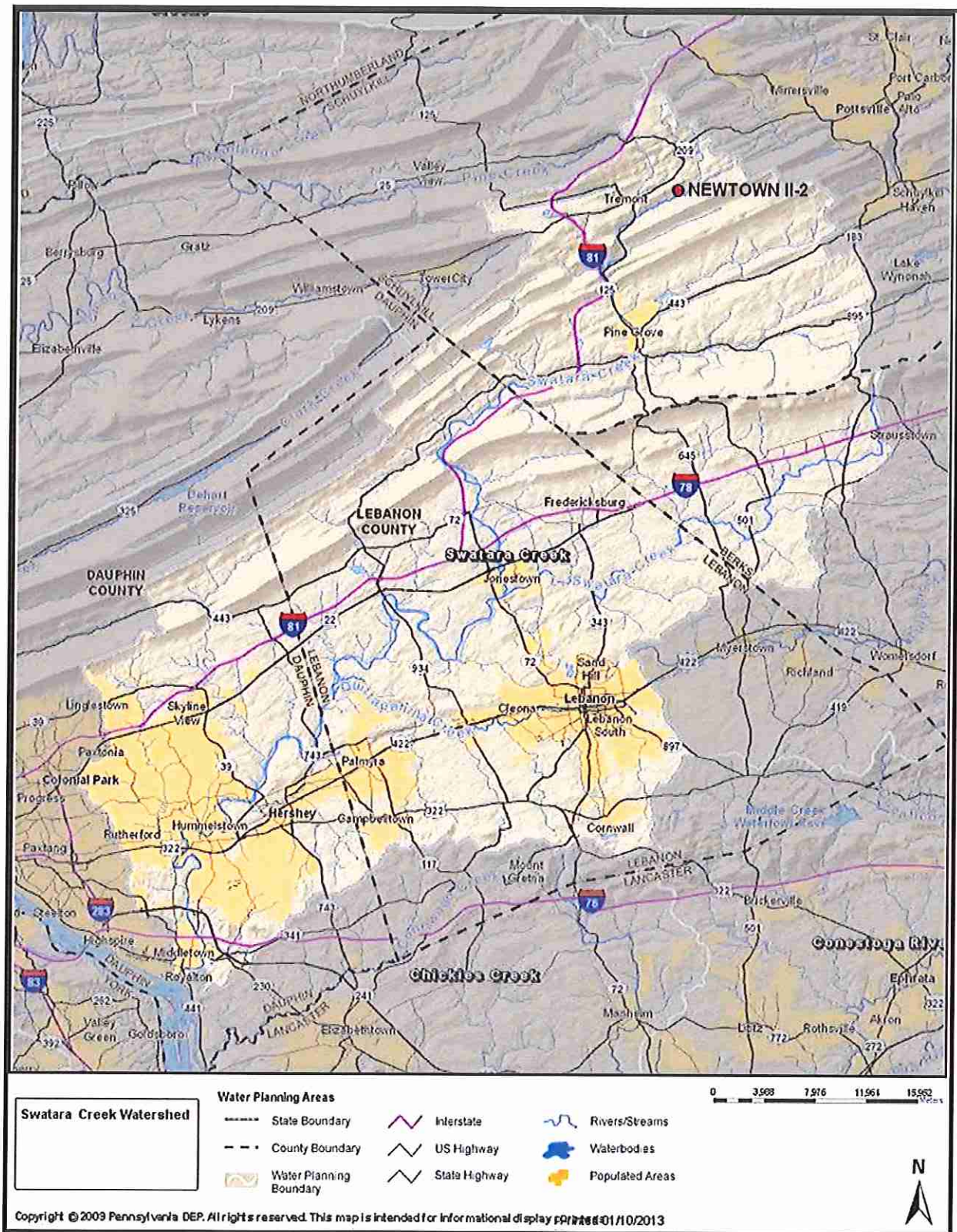


Figure A3. Swatara Creek Watershed

NEWTOWN SOUTH II-2 OSM54(3649)102.1										
AML#	PRIORITY	KEYWORD	ACRES	LINEAL FT	pH	Fe (mg/L)	alkalinity (mg/L)	acidity (mg/L)	GPM	NOTES
3	2	HWB	0.37		6.1	0.2	3.6	21.4		
4	2	HWB	0.90		6.3	0.5	5.4	32.2		
5	2	DH	1.49	100						
6	3	PI	1.00							
7	2	DH/HWB	0.69	400	4.8	0.6	1.2	34.6		
8	2	DH	0.57	500						
11	3	SA	2.00							
12	2	HWB	0.23		6.2	288	7.4	19.6		
15	3	WA			5.1				1	STRIP PIT OVERFLOW - BOTTOM OF AML#3
16	3	WA			3.4	8.2	0	65.2	10	AMD - PASSIVE TREATMENT + WETLANDS
18	3	WA			5.2	3.1	0	85.8	50	AMD - PASSIVE TREATMENT + WETLANDS
21	2	DH	5.00	100						
22	2	DH	1.00	100						
23	3	PI	2.00							SURFACE WATER INFILTRATION
24	2	VO								NO BATS IN SURVEY
25	2	VO								NO BATS IN SURVEY / BAT GATE INSTALLED
26	2	VO								NO BATS IN SURVEY

Figure A4. AML Features Reclaimed by Newtown South II-2



Figure A5. AMD Treated by Newtown South II-2

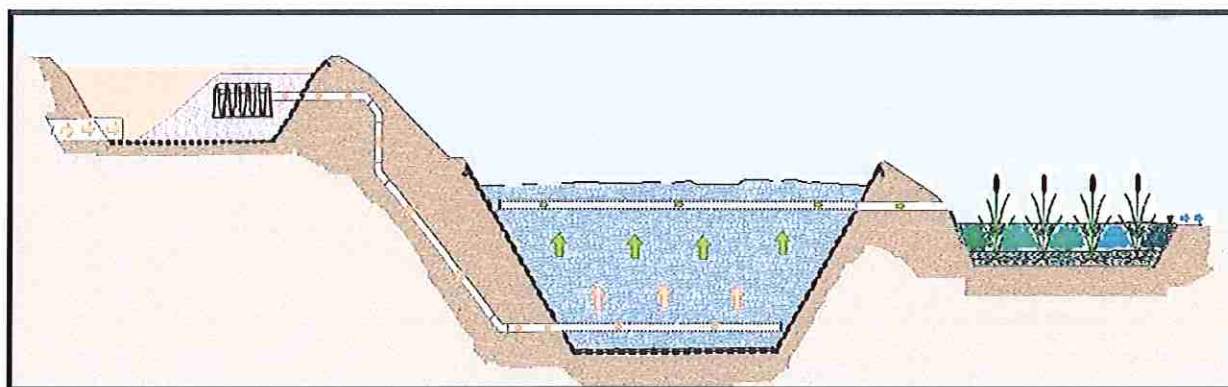


Figure A6. Diagram of Passive Treatment Systems

TREATMENT SYSTEM A 8/1/2012					
Design Flow: 10 GPM, 18 hour retention time					
PARAMETER	INTAKE	OUTLET		Wetland B Outlet	
pH	3.4	6.2		7.1	
Iron	8.2 mg/l	3.8 mg/l	-54%	1.3 mg/l	-84%
Aluminum	3.3 mg/l	2.1 mg/l	-36%	1.4 mg/l	-58%
Manganese	3.8 mg/l	3.7 mg/l	-3%	1.6 mg/l	-58%

TREATMENT SYSTEM A 4/15/2013					
Design Flow: 10 GPM, 18 hour retention time					
PARAMETER	INTAKE	OUTLET		Wetland B Outlet	
pH	3.4	6.9		7.5	
Iron	6.2 mg/l	2.8 mg/l	-55%	0.2 mg/l	-97%
Aluminum	1.7 mg/l	0.95 mg/l	-44%	0.29 mg/l	-83%
Manganese	2.9 mg/l	1.4 mg/l	-52%	0.33 mg/l	-89%

TREATMENT SYSTEM B 8/1/2012					
Design Flow: 50 GPM, 18 hour retention time					
PARAMETER	INTAKE	OUTLET		Wetland C Outlet	
pH	5.2	7.2		bypassed	
Iron	3.1 mg/l	0.7 mg/l	-77%	bypassed	
Aluminum	0.7 mg/l	0.3 mg/l	-57%	bypassed	
Manganese	1.7 mg/l	1.3 mg/l	-24%	bypassed	

TREATMENT SYSTEM B 4/15/2013					
Design Flow: 50 GPM, 18 hour retention time					
PARAMETER	INTAKE	OUTLET		Wetland C Outlet*	
pH	5.3	7.6		6.3	
Iron	7.4 mg/l	1.3 mg/l	-82%	1.1 mg/l	-85%
Aluminum	0.3 mg/l	0.29 mg/l	-3%	<0.2mg/l	-33%
Manganese	1.6 mg/l	0.2 mg/l	-24%	1.7 mg/l	6%

* discharge water short circuiting into wetland

Figure A7. Treatment Systems Performance



Figure A8. Treatment System Being Installed



Figure A9. Operating Treatment System



Figure A10a. Treatment System Solar-Powered Valve

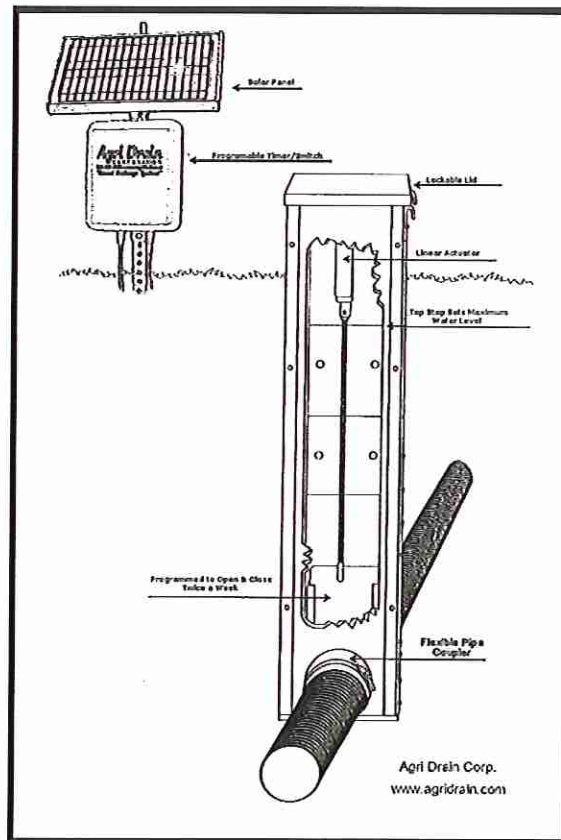


Figure A10b. Treatment System Solar-Powered Valve



Figure A11. AMD, Wet Conditions on Site



Figure A12. Wet conditions, Proximity of Railroad



Figure A13. Proximity of Railroad



Figure A14. Tree Seed Planting Area – Newtown South II-2

NEWTOWN SOUTH II-2 TREE SEED AREA					
Seed Type Planted	lbs./acre	total lbs.	Observation	Volunteer Tree Growth	
Quaking Aspen	0.2	1.5	Sparse population Growth up to 18"	Tree Type	Observation
Common Persimmon	1.0	7.4	Several observed. Growth to 12"	Shining Sumac	Sparse to fair population to 18"
Russet Buffaloberry	0.25	1.9	Only one observed. Growth to 8"	Smooth Sumac	Sparse population to 18"
Flowering Dogwood	0.2	1.5	None observed	Sassafras	Sparse to fair population to 12"
Eastern White Pine	0.2	1.5	None observed	Black Birch	Sparse population to 12"
Cockspur Hawthorne	0.2	1.5	None observed*	Catalpa	Sparse population to 18"
American Filbert	1.0	7.4	None observed*	Black Cherry	Sparse population to 18"
*Most tree seed requires cold stratification to aid germination, and in the case of Common Persimmon and Cockspur Hawthorne, two cold stratification periods are usually needed for germination. At this observation, planting had not experienced any cold weather since the seed was sown.				Scarlet Oak	Several observed
				White Oak	Several observed
				American Chestnut	One near limits of tree seed area
				Area planted 4/2012, observed 9/24/2012	

Figure A15. Six-Month Results of Tree Seed Planting at Newtown South II-2



Figure A16. Tree Seed Area at Branchdale (3 years growth)



Figure A17. Newtown South II-2 Reclaimed to AOC Before Seeding



Figure A18. Newtown South II-2 Revegetation During First Growing Season



Figure A19. Revegetation After First Winter



Figure A20. Habitat in Constructed Wetlands



Figure A21. “Ducks on the Pond” - Constructed Wetlands



Figure A22. HWB Before Reclamation



Figure A23. Second HWB Before Reclamation



Figure A24. Another HWB During Reclamation



Figure A25. Dangered-off VO Before Reclamation



Figure A26. VO Before Reclamation, Batgate



**Figure A27. Bat Gate installed in Figure A26 VO.
Shown with OSMRE and DOI Tour Group**



**Figure A28. BAMR Signs for Newtown South II-2
and Newtown South I (2000) at US-209 Entrance to SGL 229**



Figure A29. BAMR Sign for Blackwood West (2001) at US-209 Entrance to SGL 229



Figure A30. Bird Boxes Put to Good Use